

Administrator's Column

(In this column, NASA Activities features an article by NASA Administrator James Beggs. These articles focus on subjects chosen by him that address topics of broad interest to the agency's employees. The column this month features an address presented to ~~Town Hall of California~~ Ames Research Center



The Rotorcraft Industry

I am delighted to have this opportunity to join in this celebration of 2 decades of a most productive and mutually beneficial relationship. Indeed, it has been a happy union of talent,

expertise and facilities for both NASA and the Army. We've both benefitted greatly, but the nation has been the biggest winner of all. And we can be proud of that.

Nearly 2,000 years ago, Cicero, the greatest of Roman orators, said: "There is no more sure tie between friends than when they are united in their objects and wishes." That has certainly been the case with the NASA-Army Joint Cooperative Agreement.

As we look back on the history of the agreement, we can be proud that it has not only strengthened our joint ties, but provided untold benefits to the aeronautical research community and to the country. You have heard much about that history and our mutual accomplishments today, so I don't go around that course again at length.

Rather, I'd like to focus on why we conduct rotorcraft research in the first place; what gains we can anticipate from our efforts and what could lie beyond the next generation of rotorcraft.

Continued growth and progress in aeronautical research and technology is essential to the continued success of the United States civil aeronautics industry. And one of our major challenges today is to keep that industry healthy and cost-effective in the face of strong competition from abroad.

It is terribly important that we do this. For air transportation is a key element in the United States economic infrastructure. Much of our commerce at home and abroad moves by air. The aerospace industry employs more than 1.2 million people and accounts for 2.5 per cent of our G.N.P. Moreover, American aircraft are second only to agriculture in export value and thus play a vital role in trade. And, as we all know, the aeronautical industry spawns high technology innovation in a wide variety of industrial applications.

The rotorcraft industry is a vital leg of both our civil and military air establishments. On the civil side, helicopter sales totaled \$336 million last year and that figure is projected to increase to \$536 million this year.

Those figures may sound rosy. But, for the longer-term, the economic outlook for our rotorcraft industry is not bright. American-made helicopters face intense competitive pressures from abroad. The United States' share of the international market has declined from more than 80 per cent in 1970 to about 55 per cent today. It is currently projected to dip to about 35 per cent by the year 2005.

Foreign government subsidies and the favorable financial arrangements they provide their manufacturers have contributed to our decline in this area. To fight back effectively, it is clear that we will have to build better and smarter machines than those of our rivals and sell them at competitive prices. In short, we must develop and incorporate new and innovative technology into our helicopters and move them into the market faster than we do today.

The NASA-Army Joint Agreement has given us a solid foundation to build a rotorcraft research and technology base to enable us to take on that challenge with confidence. From that foundation, we can, indeed, build a rotorcraft research and technology base second to none.

Our current joint rotorcraft program evolved from autogyro research begun in the 1930s by the National Advisory Committee on Aeronautics, NASA's predecessor agency. As work progressed, NACA, and later, NASA, developed close ties to military R&D groups.

In 1965, NASA formalized its relationships with the Army in the Joint Agreement. The goal was "to achieve tangible economies and promote efficiency with respect to continuing R&D of aeronautical vehicles."

We have done that. The agreement has been cost-effective. And it has worked to benefit the interests of both signers because it gives each a free hand to adjust readily to the others' needs without undue restrictions.

Euripides wrote: "Joint undertakings stand a better

chance when they benefit both sides." That has been the key to the success of our joint undertaking.

Two major experimental aircraft programs jointly funded under the agreement are the Tilt-Rotor and the Rotor Systems Research Aircraft. Both have been highly successful, largely because the agreement allows us to capitalize on NASA's unique research facilities and on both the Army's and NASA's strong R&D capabilities.

We have made great progress together. We have used the 40×80 wind tunnel for large-scale or full-sized tests; the Transonic Dynamics Tunnel for aeroelastic tests; and the Vertical Motion Simulator for flight characteristics.

We have both learned much from flight research vehicles and from high-speed computational facilities, here at Ames and at NASA's Lewis and Langley Centers and at the Army's Aviation Applied Technology Directorate at Fort Eustis, Virginia.

Our ongoing joint research activities continue to grow, particularly in the areas of crew station research, advanced rotor designs, composite applications and small engine technology.

Technology improvement is the key, not only to advancing our market share in the world, but to greater and more sophisticated uses for rotorcraft.

Over the past decade, rotorcraft use has expanded greatly, in both the military and civil arenas. Rotorcraft now are an integral part of our combat capability. Civil applications range from commuter transportation and forestry to resource exploration and development and emergency medical services.

In the future, we can expect that even more uses will be found for rotorcraft in both cities and rural areas. Clearly, technology improvements are essential if American rotorcraft are to remain competitive in the world. Such improvements will result in increased productivity at lower unit costs.

Our goals must include quieter, safer and more fuel-efficient vehicles that operate with less vibration than those of today. We must aim for higher speeds, greater range, longer endurance and an all-weather capability. We must ensure greater reliability and reduced maintenance requirements.

And for the military, we must find ways to attain low observability as well.

Those goals are ambitious, yet achievable. They can be attained if we concentrate skills, imagination and resources on such vital areas as aeromechanics, automation, propulsion systems, and innovative configurations.

There is much to do in each of these areas. Let me give you a few examples.

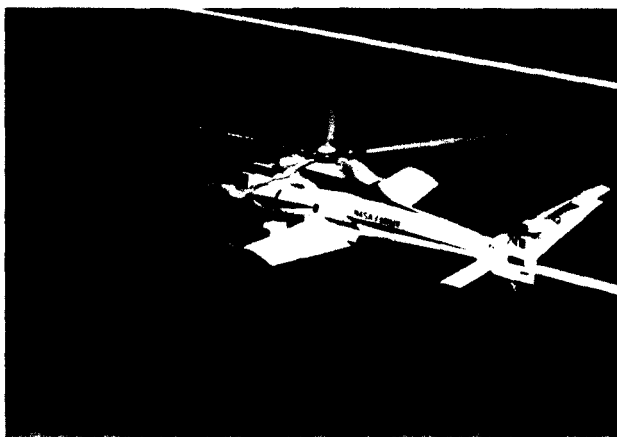
In the area of aeromechanics, we need to work to

better understand three-dimensional, unsteady flow effects, airload pressure distribution across the rotor and coupled rotor/airframe response characteristics.

In the field of automation, we must apply revolutionary advances in electronics to improve mission performance and safety. Here, especially, we need design guidelines for visual, auditory and tactile information transfer systems.

The propulsion system is the heart of a rotorcraft. These systems are very expensive and cost a lot to maintain and operate. We can improve them and lower their costs through better internal flow analyses and use of advanced materials, such as composites and ceramics in engine components.

To reach the high-speed cruise flexibility of modern fixed-wing aircraft and still hover efficiently, we must be innovative in our designs. We have successfully demonstrated the Advancing Blade Concept, or ABC, and tilt-rotor technologies and will soon fly the stopped-rotor X-Wing. We must move these configurations rapidly from the research arena into operational use.



The Rotor Systems Research Aircraft (RSRA) takes off from NASA's Ames Research Center. It was developed to test advanced helicopter rotor systems under actual flight conditions. The RSRA flies as a helicopter, as a compound helicopter (with wings and auxiliary engines) or as a fixed-wing airplane.

Application of these advanced technologies to the next generation of rotorcraft would provide dramatic benefits. They would reduce external noise and fuel consumption by half and attain vibration levels of less than $\pm .05g$, or about the same level of smoothness as a modern-day jet aircraft. We would have rotorcraft capable of operating normally under all weather and environmental conditions, with a 40 per cent improvement in reliability and maintainability.

Such improvements translate into the all-important bottom line: greater productivity, probably a four-fold

increase for helicopters and nearly a six-fold increase for advanced configurations.

Let me turn briefly now to what we can expect to see in rotorcraft beyond the next generation, beginning in about the year 2025 and beyond. There is no question that by then, advanced technology applications will have improved design, development and operating capabilities to a degree we can hardly imagine today.



The Tilt-Rotor Research Aircraft has helicopter-like rotors which tilt up for vertical takeoff and landing. The rotors also tilt forward for conventional horizontal flight, enabling speeds up to 350 miles per hour.

Design will probably be automated, thus reducing much of the laborious, repetitive work we do today. Automation in manufacturing will also ensure high quality in volume production.

Crews will be trained and designs will be developed with the aid of high fidelity, ground-based simulators.

We can also expect widespread use of such advanced materials as polymers that "heal" themselves; electric propulsion systems; and artificial intelligence applications; some perhaps using biocomputer chips.

And, with a second-generation X-wing, ABC or tilt-rotor, we will be flying much faster, approaching or possibly exceeding transonic speed.

Some 300 years ago, Baron von Leibnitz, the German philosopher and mathematician wrote: "The present is great with the future." And so it is with us today.

Our challenge is to continue to build a firm foundation for new generations of American rotorcraft; faster, safer, more flexible and more efficient than any on the drawing boards today.

Working together, I am confident we will meet that challenge. NASA/Army cooperation, which has proved so fruitful over the past 20 years, will continue to grow, paving the way for a new era of rotorcraft for tomorrow.

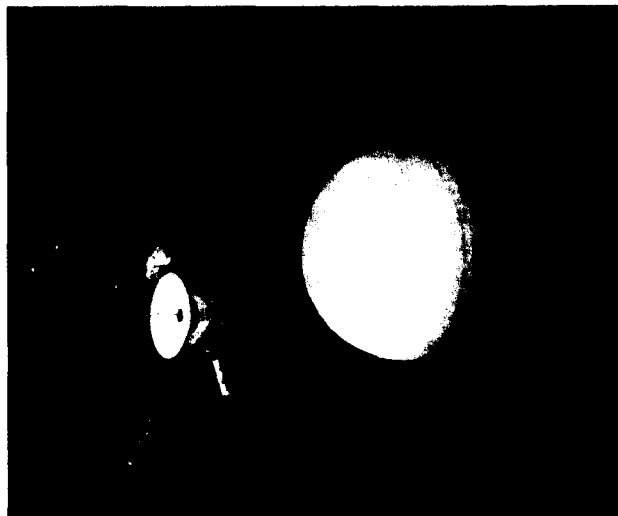
Focusing On Uranus

Uranus, the ringed gas giant that rotates on its side, is the next planet targeted to become a place, rather than a point of light, under the gaze of the camera mount aboard Voyager 2.

The venerable deep space probe, hurtling along at 45,000 miles an hour, is now just 3 months from its close encounter with Uranus. The close encounter will take place at the same time as Earth turns an eye to Comet Halley, and as NASA readies the first polar Shuttle flight. The spacecraft will pass within 66,000 miles of the planet at 10 a.m. PST on Jan. 24. The signal will take 2 hours, 45 minutes to travel from the spacecraft to Earth. The encounter ends Feb. 25, 1986.

The twin spacecraft Voyagers 1 and 2 were launched in August and September 1977 on trajectories that would take them to Jupiter and Saturn, then deliver each spacecraft to explore different regions of space outside our solar system. Voyager 1 has completed its planetary encounters and is returning information as it travels upward through unexplored space in a path away from the ecliptic plane. It will eventually reach interstellar space.

Meanwhile, Uranus and Neptune have been added to Voyager 2's itinerary. After its Uranus encounter, the spacecraft, its flight path changed by that planet's gravity and gaining velocity from the planet's orbital motion, will arc toward Neptune, which it will encounter on Aug. 24, 1989. These gravity-assisted trajectory changes, which require passing each planet at a precise point in space, are the key to Voyager 2's ability to visit all four giant planets in only 12 years.



Artist concept of Voyager encounter with Uranus.